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(54) **SYSTEMS AND METHODS FOR DASHBOARD IMAGE GENERATION**

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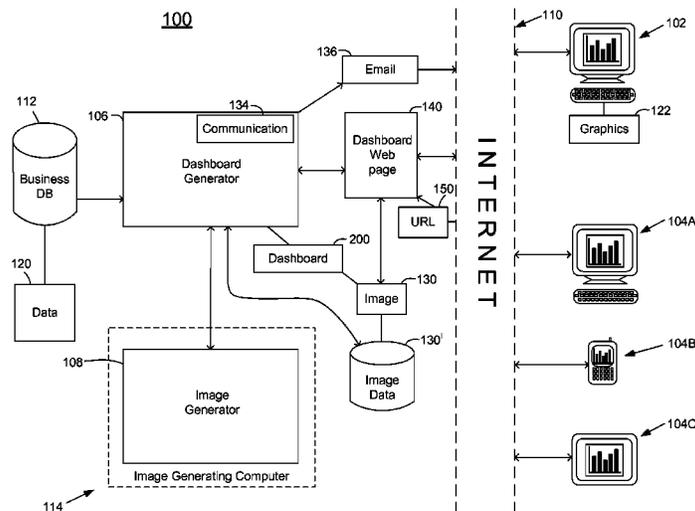
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(57) **ABSTRACT**

Systems and methods for generating a dashboard image for  
viewing on a remote computing device. The system may  
include a business database storing a plurality of business  
values; a dashboard generator; an image generator and a web  
page generator. The dashboard generator may be configured  
to derive a plurality of key performance indicator values  
from the business database and generate a dashboard corre-  
sponding to the plurality of key performance indicator  
values. The image generator may be configured to generate  
the dashboard image, such that the dashboard image corre-  
sponds to the dashboard. As well, the web page generator  
may be operatively coupled to the image generator and  
configured to generate a dashboard web page corresponding  
to the dashboard image. The method may include: receiving  
a dashboard image request from the remote computing  
device; deriving a plurality of key performance indicator  
values from a business database; creating a dashboard image  
corresponding to the key performance indicator values; and  
generating a dashboard web page corresponding to the  
dashboard image.

**19 Claims, 6 Drawing Sheets**



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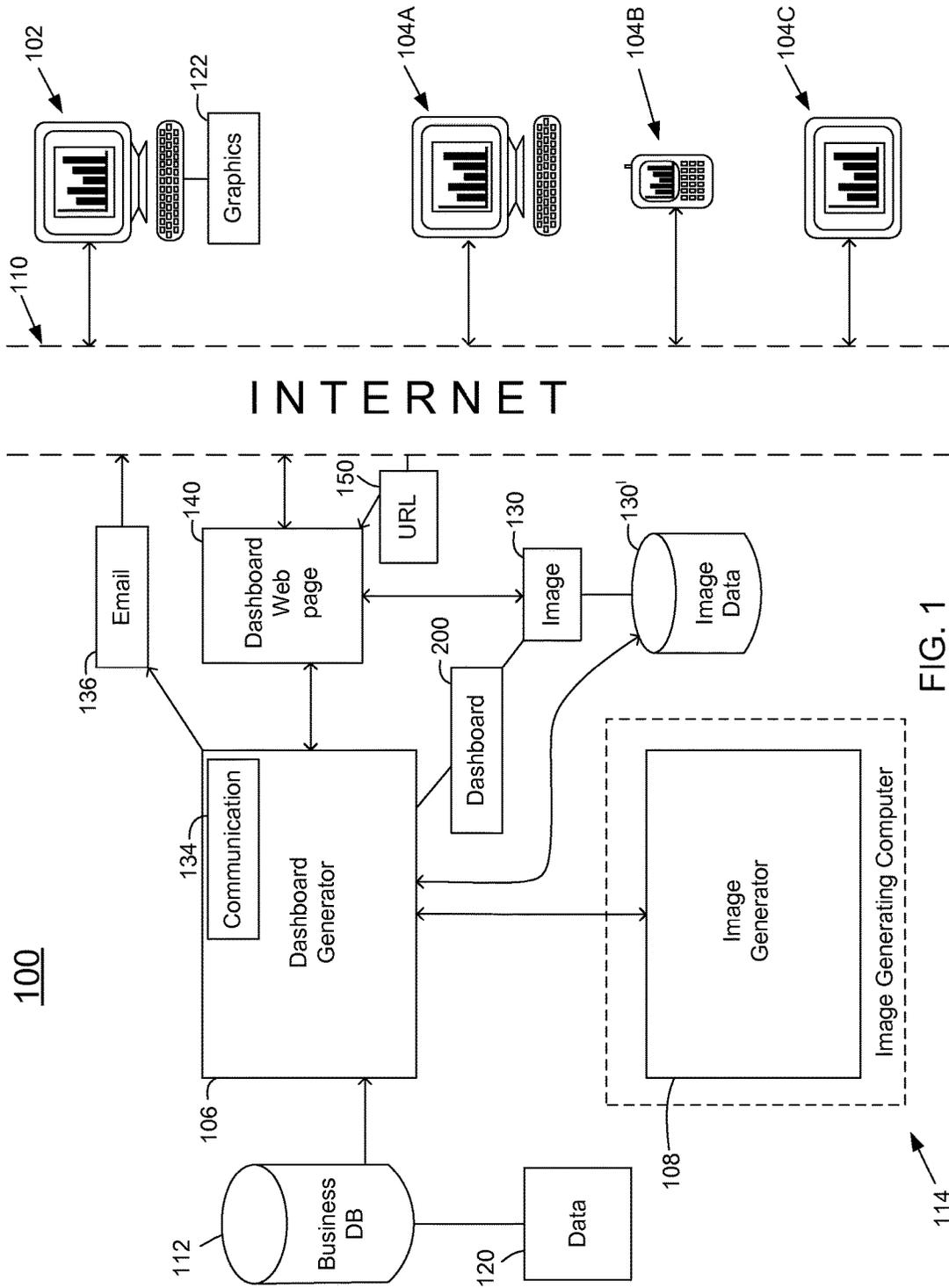


FIG. 1

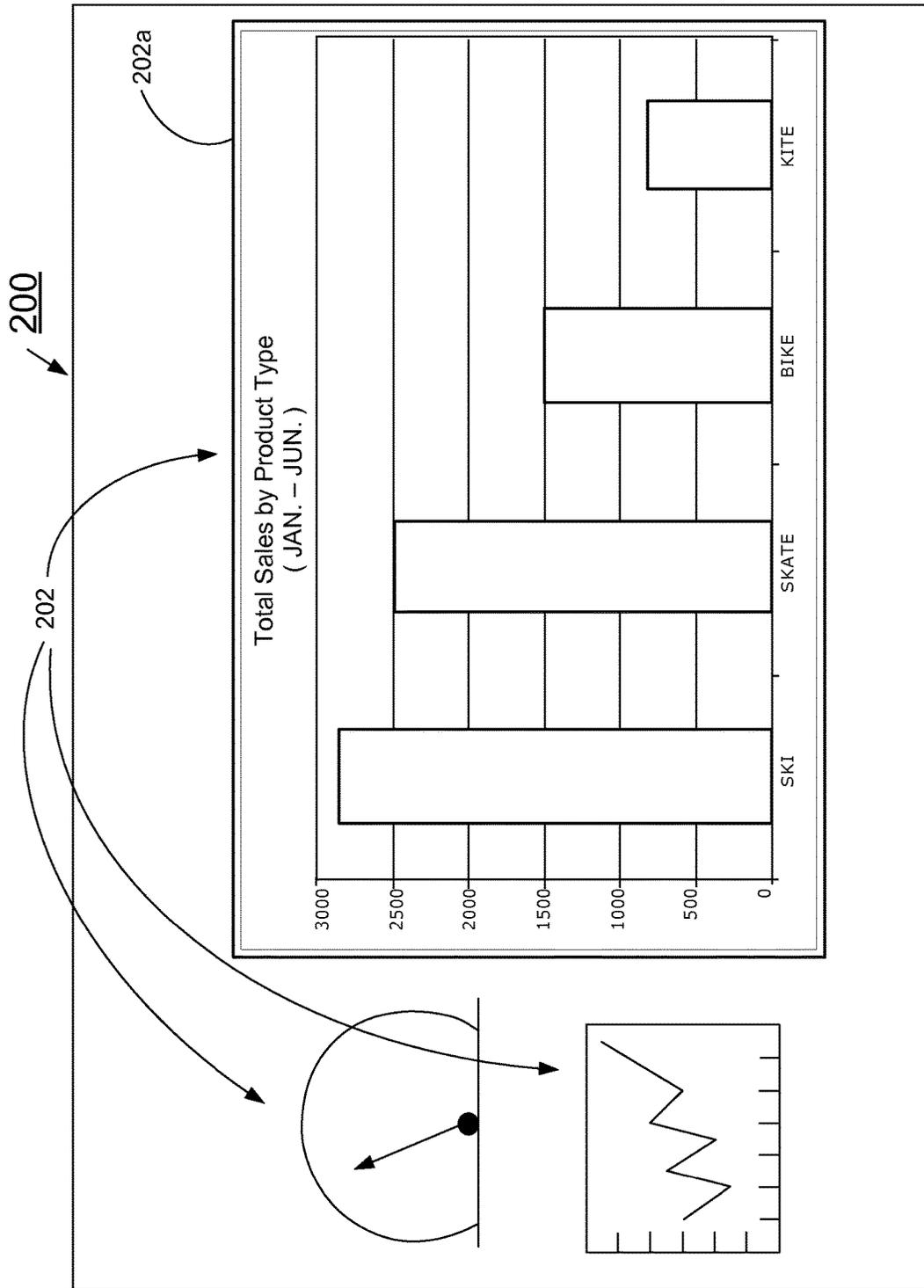


FIG. 2

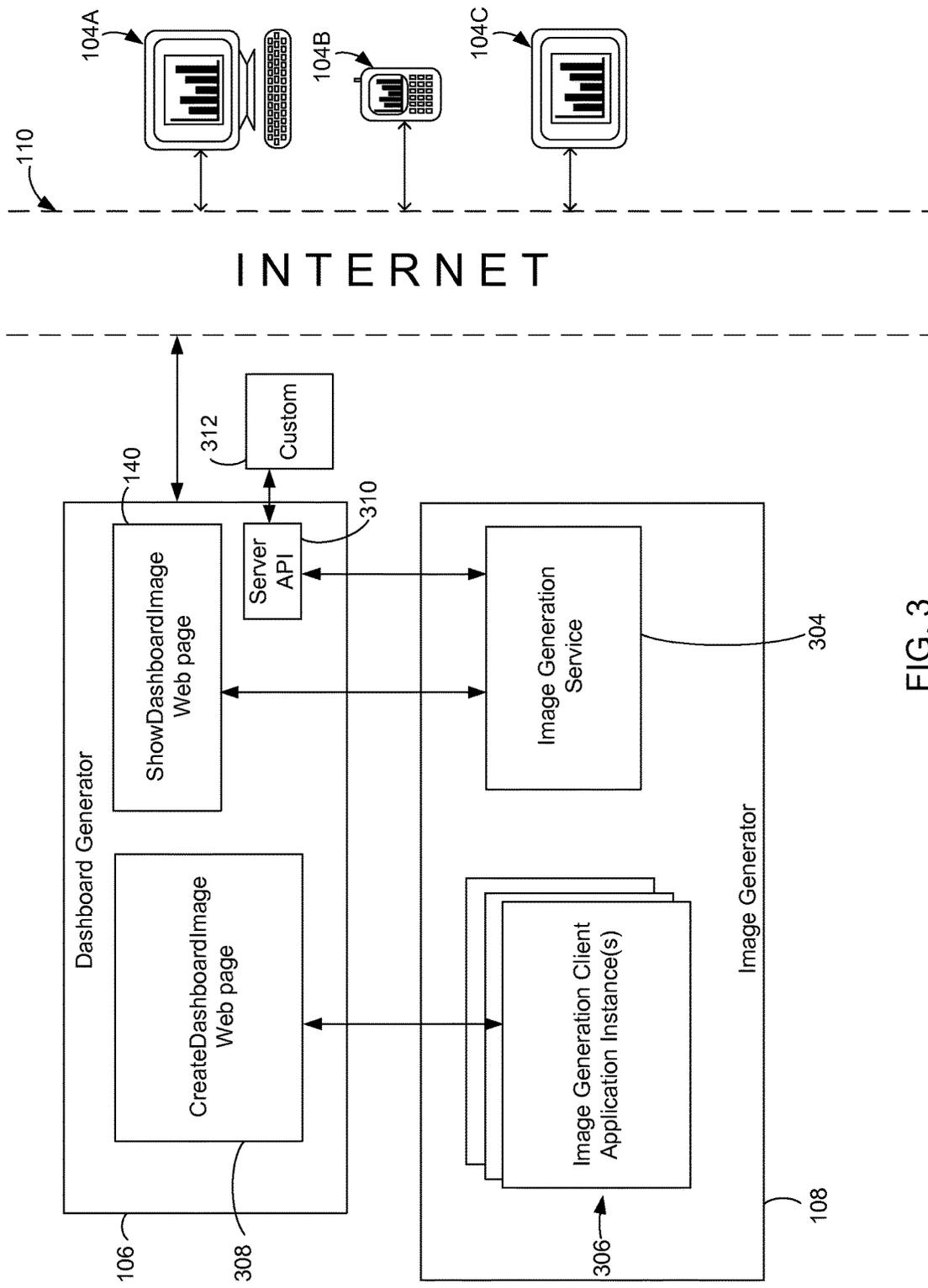


FIG. 3

400

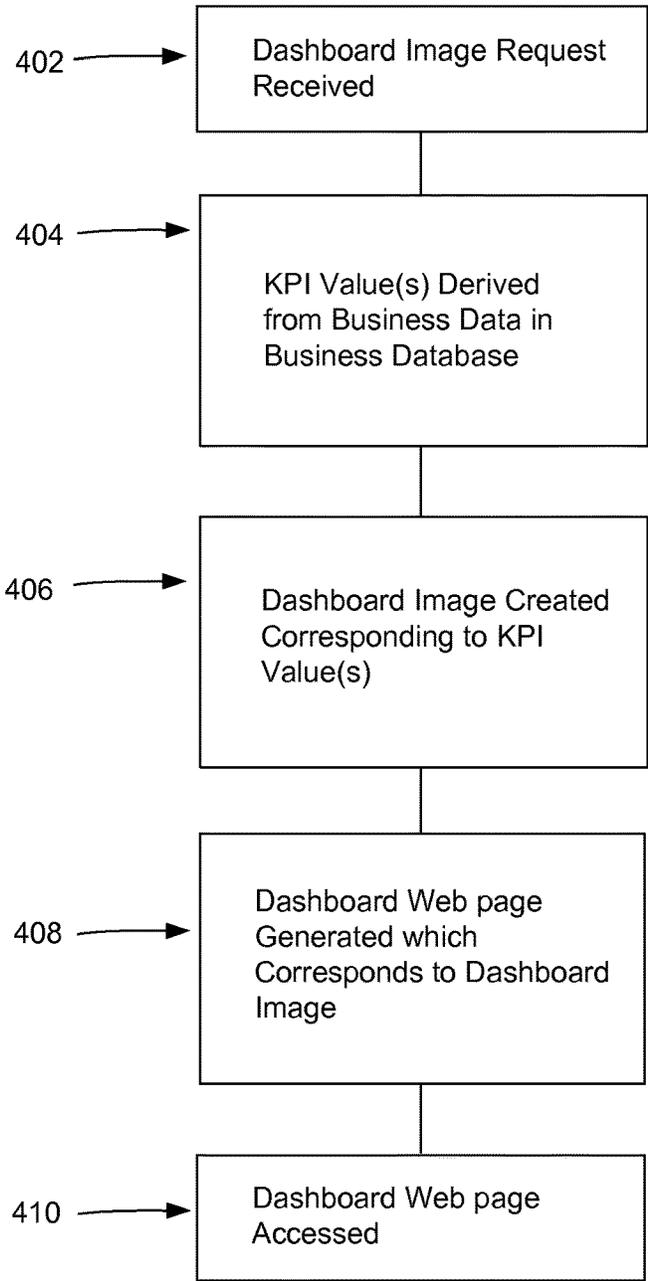


FIG. 4

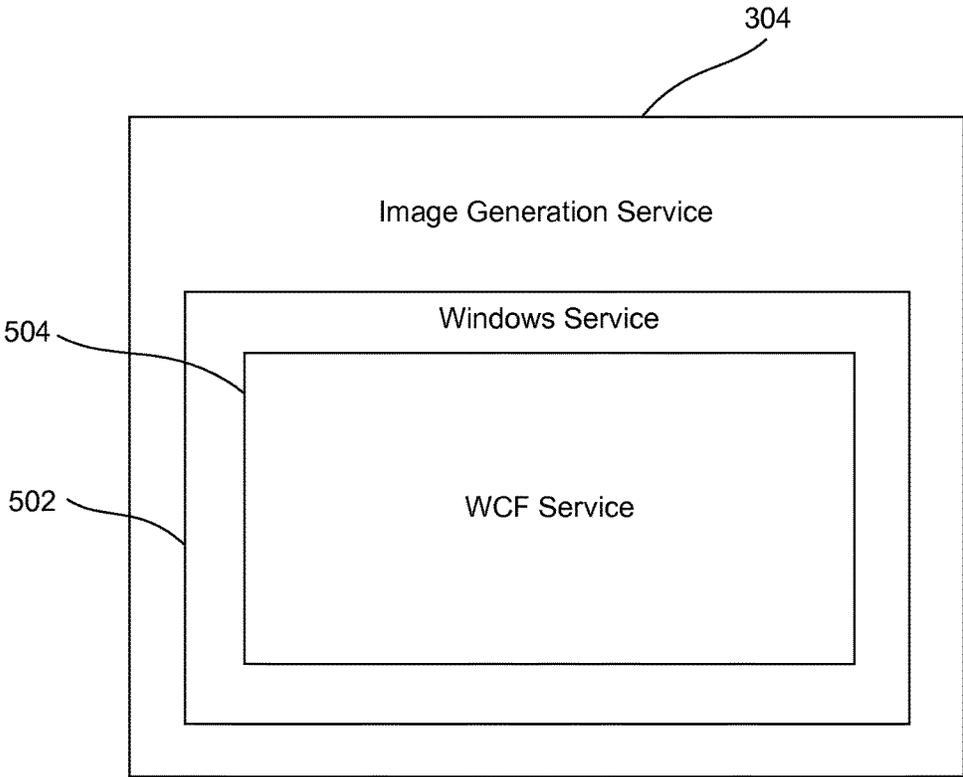


FIG. 5

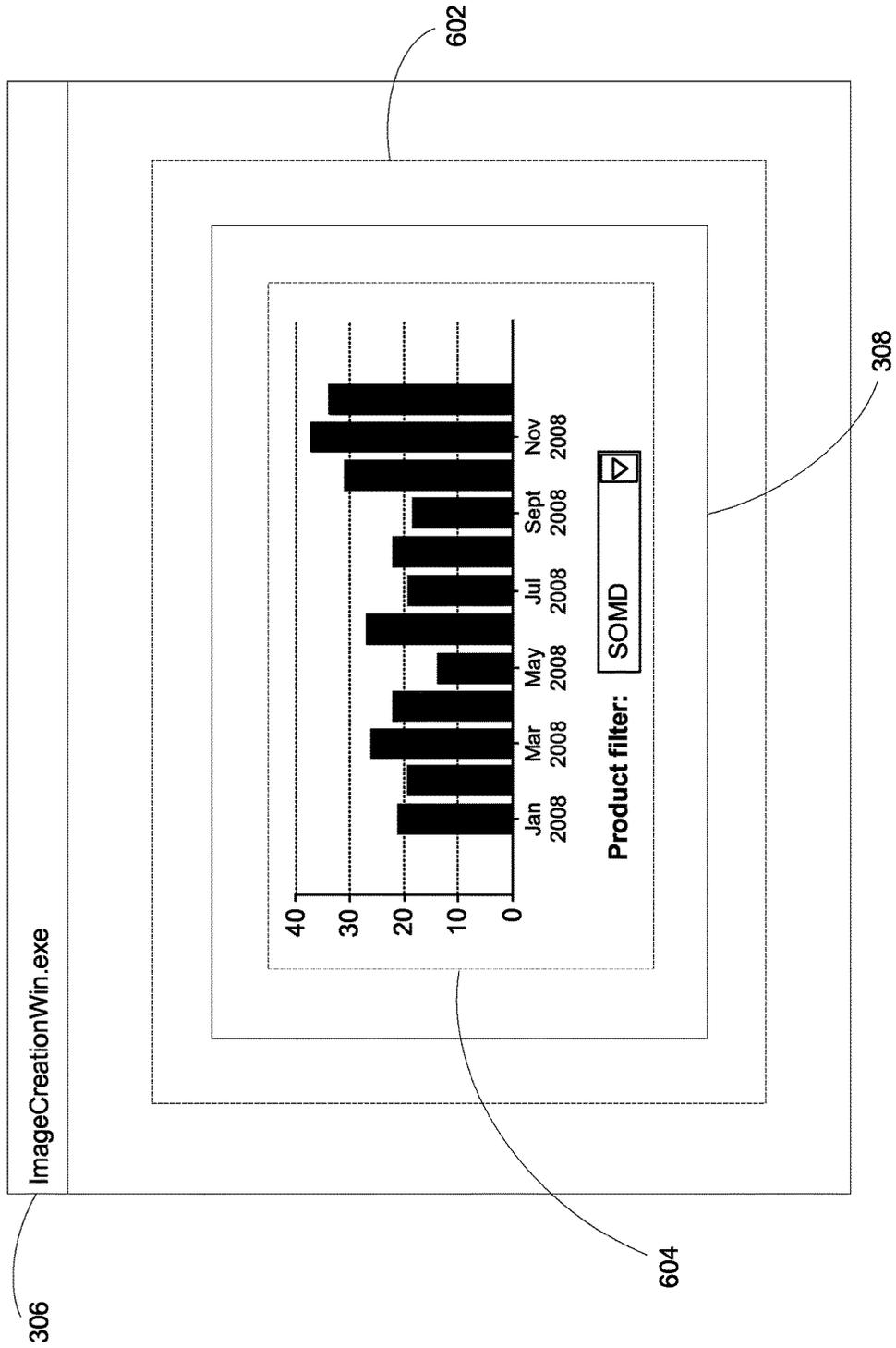


FIG. 6

## SYSTEMS AND METHODS FOR DASHBOARD IMAGE GENERATION

### PRIORITY

This application is a continuation of U.S. patent application Ser. No. 13/267,955, filed Oct. 7, 2011, which claims the benefit of U.S. provisional patent application No. 61/390,642, filed Oct. 7, 2010. The entire contents of U.S. patent application Ser. No. 13/267,955 and U.S. provisional patent application No. 61/390,642 are hereby incorporated by reference.

### TECHNICAL FIELD

The described embodiments relate generally to the creation and distribution of images of dashboards, with common but by no means exclusive application to the display of such images on mobile communication devices or other computer devices operatively coupled to the Internet.

### BACKGROUND

“Dashboards” present visualizations, for example, in graph or chart form, of key performance indicator (KPI) metrics or information derived from business values or data stored in business databases. Such visualizations may be viewed (e.g., on a computer screen or other display device) by executives to obtain an overview of how a business is performing.

The inventors have recognized that it may be desirable to be able to view dashboard information on a computing device that is remote or otherwise separate from the server or system creating the dashboard. Such remote computing device may not have a software graphics platform. The inventors have recognized a need for improved systems and methods for generating and displaying images of dashboards. The embodiments described herein may address in whole or in part some or all of the above-noted challenges.

### BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments are described in further detail below, by way of example only, with reference to the accompanying drawings, in which:

FIG. 1 is a schematic diagram of one implementation of a system for generating a dashboard image for viewing on a remote computing device, in accordance with the present disclosure;

FIG. 2 is a schematic illustration of an exemplary dashboard, as may be generated in accordance with the present disclosure;

FIG. 3 is a schematic illustration of the internal components of the dashboard generator and the image generator of FIG. 1 shown in greater detail, in accordance with the present disclosure;

FIG. 4 is a flowchart illustrating the steps in a method for generating a dashboard image for viewing on a remote computing device, in accordance with the present disclosure;

FIG. 5 is a schematic illustration of the internal components of the image generation service of FIG. 3 shown in greater detail, in accordance with the present disclosure; and

FIG. 6 is a schematic illustration of the internal components of the image generation client application and Create-

DashboardImage web page of FIG. 3 shown in greater detail, in accordance with the present disclosure.

### DETAILED DESCRIPTION

The embodiments described below relate generally to a dashboard creation and management system that lets users view data visualization dashboards. Dashboards may display graphical elements that contain visual representations of key performance indicators for a business. KPIs may be business metrics that assist a business to better understand the data it has collected relating to the operation of the business. By way of example only, a dashboard created for a retail business might illustrate in graph form the business’ retail sales over a period of time. Such exemplary dashboard might also illustrate in a pie chart the retail sales by product category (eg. clothing, shoes, sporting equipment) over the same (or a different) period of time. As will be understood, the nature of the KPIs displayed will vary based on the nature of the business and the needs of the individual wishing to view and understand different business metrics.

For the purposes of the present disclosure such a dashboard creation and management system may typically include two types of dashboard viewing users (who are often business executives): those who are able to view and interact with a dashboard (referred to generally below as “interactive viewers”), and those who are only able to view a static image of a dashboard, without being able to interact directly with the dashboard (referred to below generally as “remote viewers”).

Dashboards may be designed to be interactive in a number of different ways. For example, an interactive viewer may be able to configure the date ranges to be used for filtering the business data which is to be represented in the KPIs on the dashboard. Some dashboards may be configured to allow different categories of business data to be represented in the KPIs, such as product types sold or sales by selected stores. Any particular dashboard may provide a variety of interaction options appropriate for the application.

As will be understood, the software required to interact with a dashboard (which would typically be installed on a business’ office computers) may not be available on all computing devices to which an executive has access (for example, a smartphone, a tablet, or a personal computer which has not been configured with the necessary software). While away from the fully configured computers available at a business’ office, an executive may still desire to view a dashboard, even if interactive functionality is not available.

One aspect of the technology described herein relates to a method for generating a dashboard image for viewing on a remote computing device. The method may include: receiving a dashboard image request from the remote computing device; deriving a plurality of key performance indicator values from a business database; creating a dashboard image corresponding to the key performance indicator values; and generating a dashboard web page corresponding to the dashboard image.

In some implementations, the dashboard web page may be accessed by the remote computing device. As well, the dashboard image request may be communicated via the Internet. In some instances, the dashboard image request corresponds to a dashboard URL. In turn, the dashboard web page may also correspond to or be accessed via the dashboard URL.

The method may also include communicating a message corresponding to the dashboard image request to the remote computing device. The message may be communicated via

the Internet. In some instances, the message includes the dashboard image. In addition or in the alternative, the message may include a dashboard URL or other storage address for locating the dashboard image.

The dashboard image may be created on an image creating computer, wherein the remote computing device is remote or otherwise separate from the image creating computer.

As well, in some implementations, the dashboard image request comprises at least one parameter and the dashboard image corresponds to the at least one parameter.

One aspect of the technology described herein relates to a system for generating a dashboard image for viewing on a remote computing device. The system may include a business database storing a plurality of business values; a dashboard generator; an image generator and a web page generator. The dashboard generator may be configured to derive a plurality of key performance indicator values from the business database and generate a dashboard corresponding to the plurality of key performance indicator values. The image generator may be configured to generate the dashboard image, such that the dashboard image corresponds to the dashboard. As well, the web page generator may be operatively coupled to the image generator and configured to generate a dashboard web page corresponding to the dashboard image.

In some implementations, the web page generator may be operatively coupled to the dashboard generator. Alternatively, the web page generator may form part of the dashboard generator. The web page may be configured to receive a dashboard image request from the remote computing device. Such a dashboard image request may be communicated via the Internet. Sometimes, the dashboard image request corresponds to a URL. The dashboard web page may correspond to the URL. For some configurations, the dashboard image request includes at least one parameter and the dashboard image corresponds to the at least one parameter.

In some implementations, the dashboard generator is configured to communicate a message corresponding to the dashboard image request to the remote computing device. The message may be communicated via the Internet. As well, the message may include the dashboard image.

In some implementations, the image generator comprises an image creating computer and wherein the remote computing device is remote or otherwise separate from the image creating computer.

Referring to FIG. 1, illustrated there is a block diagram of one possible embodiment of a system for generating a dashboard image for viewing (on a remote computing device), shown generally as **100**. The system **100** may include one or more fully enabled client terminals **102**, one or more remote terminals or computing devices **104A**, **104B**, **104C**, a server-side dashboard generator module **106** and an image generator **108**. Each of these components may be networked (in addition to being coupled to the Internet **110**) and be operable to communicate with each other. While connectivity is described herein throughout in relation to the Internet **110**, it should be understood that other types of networks, such as a local area network (LAN) may be used. Without intending to be limiting, the remote computing devices may, for example, be in the form of a personal computer **104A**, a smartphone **140B**, or a tablet **104C** configured with a web browser. The remote computing devices **104A**, **104B**, **104C** will also typically be configured with an email reader.

Further, while the generator module **106** and image generator **108** are illustrated as being separate components, it

should be understood that in some implementations, the image generator **108** may be considered to comprise part of the dashboard generator module **106** and/or reside on the same server/computer. The system **100** may also include a business database **112**. A business data server (not shown) may also be provided which executes software components that provide access to the business database **112**.

As will be discussed in greater detail below, the business database **112** may store business data **120** corresponding to a plurality of business values (e.g., sales, expenses, inventory or human resources data) that relate to the operation of a business. As an illustration, the business database **112** may be an accounting and inventory management database that stores transactional data for a sporting goods store. In some embodiments, the business database **112** may be stored on a separate computer or server accessible by the dashboard generator **106**.

As will be understood, all or a subset of business values may be selected from the business database **112** for the purpose of deriving (or calculating) KPI values for visualization on the dashboard to be generated. For example, the KPI values may be derived by performing a summation or other mathematical process on the business values.

Referring briefly to FIG. 2, shown there is an example dashboard **200** showing various different graphical KPI visualizations **202**. One exemplary type of KPI visualization illustrated in the dashboard **200** is the 'Total Sales by Product Type' KPI **202a**, depicting bar graph data corresponding to sales of specified products over a period of time.

Referring again to FIG. 1, exemplary client terminals **102**, remote computing devices **104A**, **104B**, **104C**, dashboard generator module **106** and image generator **108** may comprise a number of components (which have not all been illustrated), including microprocessors. In the exemplary configuration illustrated in FIG. 1, the microprocessor (which may be in the form of a server, for example) on which the software of the image generator **108** is run is referred to herein as the image creating computer **114**. As noted above, this microprocessor **114** may be the same as or different from the microprocessor(s) (which may be in the form of one or more servers, for example) on which the software of the dashboard generator module **106** runs.

Microprocessors typically control the overall operation of computer systems. Microprocessors interact with additional subcomponents such as memory storage (which may include random access memory (RAM) and read-only memory (ROM), and persistent storage such as flash memory), display, network adapter and input device(s), for example, such as a keyboard, mouse, touchscreen (which may form part of the display) or touchpad. Network adapters allow connection to different types of networks (for example, Local Area Networks (LANs) as well as Wide Area Networks (WANs)), and may be wired (for example, through an Ethernet connection) or wireless (for example, through 802.11 Wireless Local Area Network (WLAN) or cellular standards). Operating system software used by a microprocessor is typically stored in a persistent store such as flash memory or read-only memory (ROM) or similar storage. Those skilled in the art will appreciate that the operating system, specific software components, or parts thereof, may be temporarily loaded into a volatile store such as RAM. Microprocessors, in addition to operating system functions, enable execution of software components.

In the exemplary embodiment in FIG. 1, it should be understood that the computers/microprocessors of the remote terminals or computing devices **104A**, **104B**, **104C** are separate from the image generating computer **114**. Ref-

erence herein to “remote” computing devices **104A**, **104B**, **104C** is intended to convey that such computing devices **104A**, **104B**, **104C** are distinct, different and/or separate from (and do not form part of) the image creating computer **114**—in this context, “remote” is not intended to refer to geographical distance.

From a high level perspective, the dashboard generation module **106** provides interactive dashboard functionality and visualization for interactive viewers on the fully enabled client terminal **102**. While not illustrated, it will be understood that more than one client terminals **102** may access (simultaneously or otherwise) the interactive dashboard functionality provided by dashboard generation module **106**. In contrast, users may be able to view a static image of a dashboard (such as dashboard **200**) on the remote computing device(s) **104A**, **104B**, **104C** via a web page. The dashboard URL (uniform resource locator) **150** address corresponding to the dashboard web page **140** is communicated to the remote computing device(s) **104A**, **104B**, **104C** typically via the Internet, such as via email. As will be discussed in greater detail, below, the static dashboard image **130** is generated by the image generator **108** upon request from the dashboard generation module **106**.

As noted above, the business database **112** may store business data **120**. Such business data **120** may correspond to any data stored by a business organization in relation to the operation of its business. For example, this may include transactional sales data or inventory data. The dashboard generation module **106** may include a dashboard creation and management system for creating and managing executive business dashboards (such as exemplary dashboard **200** illustrated in FIG. 2) that show business metrics, typically in a graphical format. As noted above, such business metrics for the dashboard creation and management system may be derived from the business data **120**.

Dashboard generation module **106** may select certain business data **120**, generate corresponding KPIs and organize/present the KPIs in a dashboard **200** for interactive viewing by business executives using a client terminal **102** (for example, which may be in the form of a desktop or notebook PC). Such terminal **102** may be equipped with a graphics platform **122** such as Microsoft® Silverlight™ or Windows Presentation Foundation™ (WPF). Specifically, the user may use a desktop software application (e.g., equipped with WPF) or a web browser (e.g., equipped with Silverlight™) available on terminal **102** to select and interactively view a dashboard **200** of interest.

A request to view a dashboard **200** may be made from the terminal **102** to the dashboard generation module **106**. The dashboard generator **106** returns data which consists of information needed by the graphics platform **122** to render the desired dashboard **200** on the display of computer **102**. In this way, the client terminal **102** may be considered a client computer in the client-server software architecture known in the art.

As will be understood, the dashboard generation module **106** may further be configured to request that the image generator **108** create a snapshot image **130** of a specified dashboard. By “specified”, it is meant that various parameters defining the type of data and the display preferences of the dashboard are determined by the dashboard generation module **106** (often as a result of input from the user of the terminal **102**). As will be understood in the context of the following discussion, the dashboard generation module **106** may be configured to create a dashboard URL **150** corresponding to the desired dashboard **200** and its preferences.

Referring again briefly to FIG. 2, by way of example only, preferences determined for the dashboard **200** may include the products to be included in the “Total Sales by Product Type” KPI **202a** (eg. “Ski”, “Skate”, “Bike”, “Kite”), the date range of the data to be displayed (January to June), as well as the choice to illustrate the data in a bar graph format. As will be understood, other types of preferences may be determined in order to specify the KPIs to be determined and displayed, as well as the configuration of the dashboard **200**. Once the dashboard image snapshot **130** is created, the image generation system **108** returns the generated dashboard image data back to the dashboard generator module **106**. The dashboard image **130** may also be saved or cached as a dashboard image data file **130'**. Instead of returning an on-demand image, the dashboard generator **106** may be configured to return a cached image created during a previous request. Such caching can help with performance efficiency and protect against denial-of-service attacks.

Referring again to FIG. 1, the generation module **106** may include a communication module **134** configured to include the dashboard image **130** in an email message **136** by attaching the image data **130'** as a PNG (portable network graphics) file. As will be understood, a PNG file is typically viewable by a standard web browser and a standard email reader. As will be understood, while the PNG image format is described herein throughout, other appropriate image formats (for example without limitation, JPEG (Joint Photographic Experts Group)) may also be used. In addition, or in the alternative, this email message **136** may include the dashboard URL **150** corresponding to the desired dashboard **200**. Such email message **136** may then be communicated to a remote computing device **104A**, **104B**, **104C**.

The generator **106** may also be configured to host an Internet web page **140** that shows the generated dashboard image **130**. This dashboard web page **140** is accessible to a remote computing device(s) **104A**, **104B**, **104C** which has been configured with a web browser and is coupled to the Internet **110**. As noted above, the remote computing device **104A**, **104B**, **104C** may be provided with the dashboard URL **150** from receipt of the email message **136**. Once in possession of the dashboard URL **150**, as will be understood, a remote computing device **104A**, **104B**, **104C** may access the dashboard web page **140** via the Internet **110**.

Typically, the web page **140** would comprise basic HTML coding in addition to the image data **130'** and be viewable by a standard web browser—as a result, no specialized graphics platform (similar to the graphics platform **122** the client terminal **102** may be equipped with) which would otherwise be required for viewing the image **130**, is possessed by such remote computing device(s) **104A**, **104B**, **104C**.

As previously noted, the request and corresponding generation of a dashboard image **130** by the dashboard generator module **106** may be automatic (and/or periodic) or on-demand as a result of access to the web page **140** such as by remote computing device(s) **104A**, **104B**, **104C**.

Referring simultaneously to FIGS. 3 and 4, exemplary methodology and component configuration are discussed. FIG. 3 illustrates the internal components of the dashboard generator **106** and the image generator **108** and their interaction with other components of the system **100** in greater detail as may be implemented in accordance with the present disclosure. FIG. 4 is a schematic diagram of a method, shown generally as **400**, for generating a dashboard image for viewing on a remote computing device, in accordance with one or more possible embodiments.

The “on-demand” generation of a dashboard image **130** may be initiated by a computer, such as a remote computing

device 104A, 104B, 104C navigating to the dashboard image web page 140, sometimes referred to herein as the “ShowDashboardImage” web page (and which may be hosted by, and forms part of, the dashboard generator 106) at the corresponding URL in order to generate a request to view a specific dashboard as an image. A dashboard image request is received by the dashboard generation module 106 from the remote computing device 104A, 104B, 104C accessing the dashboard image web page 140. (Block 402)

As noted above, various parameters defining the type of data and the display preferences of the dashboard 200 may be specified within the dashboard URL 150 corresponding to the dashboard web page 140. Such parameters may be communicated to the generation module 106 via URL query parameters. By way of further example, such parameters may include the information needed to identify the dashboard (such as its GUID (Globally Unique Identifier) and the state of its filters (if any), which are passed in to the web page 140. An example URL comprising such parameters contained within the URL might look like the following: “http://dashsvr/ShowDashboardImage.aspx?param1=xx&param2=yy& . . .”, with “xx” and “yy” representing dummy values for exemplary parameters represented by “param1” and “param2”, respectively.

The ShowDashboardImage web page 140 may communicate a corresponding request to the image generation service 304 (which forms part of the image generator 108) to create an image 130 of the specified dashboard 200. The image generation service 304 has a specific service URL that is recorded as part of the dashboard generation module’s 106 configuration file. This is how the dashboard image web page 140 knows where to direct its request. By way of example, a service URL might look as follows: “http://imgsvr:8888/ImageCreationWebService/service”.

In response to receiving the request, the image generation service 304 may launch a new instance of an image generation client application 306 (also forming part of the image generator 108), or re-use an existing but idle instance. The client application instances 306 may be pooled on the image generating server computer 114 to allow for instance re-use. This may provide performance efficiency because there is a significant startup-time cost involved in launching a new instance of client application 306 (which may be on the order of several seconds). The image generation service 304 may also be configured to use the pool to handle multiple parallel or simultaneous requests. For example, if five requests come in at the same time, and the pool includes at least five idle client application instances 306, then all five requests will become active in parallel. If the pool of instances 306 is less than five, then one (or more) requests will have to wait until another has finished.

The client application 306 may be in the form of a Windows™ Forms program that incorporates a web browser control which allows it to navigate to and view web pages. The corresponding web browser/image generating server computer 114 is configured with the graphics platforms installed (such as Silverlight) which will allow it to display actual dashboards made available by the dashboard generation module 106. The client application 306 enables the creation of a snapshot image of the dashboard.

The image generator 108 may also be provided with its own configuration file, where one of the configuration parameters is the base URL of the dashboard generator 106. Using this base URL, the full URL of the CreateDashboardImage web page 308 managed by the dashboard generator 106 can be determined. When the client application 306 is

launched (or re-used), it navigates to this CreateDashboardImage URL, and passes in query parameters as necessary to identify the dashboard 200 to be viewed and its state. For example, the URL to access and pass in the query parameters might read as follows: “http://dashsvr/CreateDashboardImage.aspx?param1=xx&param2=yy& . . .” In terms of the implementation, it is worth noting that the client application 306 may run in an unattended mode, without any user physically operating the application 306. The image generator 108 incorporates Win32™ API (Application Program Interface) functions) to cause the application 306 to render the dashboard image.

Upon receiving the query parameters necessary to identify and/or generate the desired dashboard 200, the CreateDashboardImage web page 308 is configured to access the business database 112 and derive one or more KPI values from the business data 120. (Block 404)

When the image generation client application 306 has finished determining or rendering the dashboard 200 (corresponding to the query parameters), it creates a snapshot image 130 of it (by using graphics platform API functions—e.g., Silverlight™ API which may be incorporated within or otherwise accessible by the CreateDashboardImage web page 308 coding). (Block 406) As will be understood, the snapshot image 130 corresponds to or otherwise displays the derived KPI value(s).

The client application 306 may then communicate the generated image data 130’ back to the dashboard generator 106 (via HTML POST of the actual image data 130’ encoded as a base64 string to the CreateDashboardImage webpage/URL 308). The dashboard generator 106 may save the received image data 130’ in the form of a temporary PNG file on its server computer (e.g., on its hard drive). The dashboard generator 106 then returns back to the client application 306 the image information necessary to access/locate the image file 130’ (or it returns some error information if an error occurred).

The image information may simply be an image identifier (which, for example, may be a random number between 300 and 30000) which is used to construct the name of the temporary image file 130’ (e.g., “300.png”). Other alternative implementations could involve returning an image identifier (GUID), or the actual file path of the image file 130’ on the dashboard generator server computer.

In turn, the client application 306 returns the image (or error) information back to the image generation service 304. The image generation service 304 may then return the image (or error) information back to the ShowDashboardImage web page 140.

The ShowDashboardImage web page 140 uses the returned image information to locate the actual temporary PNG image file on the dashboard generator server computer. The image data 130’ may be read from this image file and the image file may be deleted from the dashboard generator server computer hard drive.

The resulting ShowDashboardImage web page 140 incorporates the image data 130’ inline for display of the dashboard image 130. (Block 408) This allows the requesting device, such as a remote computing device 104A, 104B, 104C, to access the dashboard web page 140 and view the dashboard image 130 in a web browser. (Block 410)

Turning briefly to FIG. 5, illustrated therein is a schematic diagram of the internal components of the image generation service 304 in greater detail as may be implemented in accordance with the present disclosure. The image generation service 304 may include a Windows™ service 502 which provides the housing for a WCF (Windows Commu-

nication Foundation) service **504**. The Windows service **502** merely provides the housing that allows the image generation service **304** to run unattended on the image generation server computer. This Windows service **502** must be run under the context of a user account that has administrative privileges on the image generation server computer **114**. The use of a Windows service **502** also allows for the automated scheduling of dashboard image requests on a periodic basis.

The WCF service **504** handles communication with the dashboard generator **106** and manages the pool of client application instances **306**. It also receives dashboard image requests (for example, from the ShowDashboardImage web page **140**) and returns image information back to the dashboard generator **106**.

Turning briefly to FIG. 6, illustrated therein is a schematic diagram of the internal components of the image generation client application **306** and CreateDashboardImage web page **308** in greater detail as may be implemented in accordance with the present disclosure. In some implementations, client application **306** may be a Windows Forms application program (eg. ImageCreationWin.exe). In the example embodiment, the client application **306** contains an embedded web browser control **602** configured to enable the loading and displaying of web pages. The web browser control **602** may be Silverlight-capable. The CreateDashboardImage web page **308** may be loaded into the web browser control **602**. The web page **308** is configured to display an interactive, Silverlight-based dashboard **604**.

Referring again to FIG. 3, in addition or in the alternative to the “on-demand” configuration and methodology for generation of a dashboard image **130** described above, the system **100** may be configured with an “API” pipeline which is similar to the “on-demand” configuration and methodology. In this case, a custom server application or add-on module **312** uses the dashboard generator’s **106** public server API **310** to create a dashboard image **130**. Specifically, the custom server code **312** may call a “GetDashboardImage” server API function which initiates a dashboard image request in a similar fashion as the on-demand pipeline process noted above. As a result of such request, the generated image data **130'** is returned to the custom server application **312**. The inclusion of such an API pipeline allows third-party developers to create server extensions that make use of dashboard images **130**.

As discussed above, to view a dashboard image, a remote device such as remote computing devices **104A**, **104B**, **104C** needs to navigate to a specific URL hosted by the dashboard generator **106** and pass in URL query parameters to specify the dashboard and its desired state (e.g. what values are the date and/or product filters set to, etc). For example, the query parameters may include the dashboard’s GUID identifier, whether a timestamp should be embedded in the dashboard image, and other options, etc. For illustration purposes only, such a URL might appear as follows: “http://dashsvr/ShowDashboardImage.aspx?param1=xx&param2=yy& . . .”.

This dashboard URL **150** which corresponds to the dashboard **200** can be determined by an interactive viewer using a client computer **102**. Such interactive viewer may view an actual interactive dashboard and set up the filters and dashboard parameters as desired. The dashboard generator **106** may be configured to enable the generation of a dashboard URL **150** corresponding to the dashboard **130** and filters/parameters as determined by the interactive viewer on the client computer **102**. Once it has been determined, the dashboard URL **150** may be communicated to one or more of the remote computing devices **104A**, **104B**, **104C** typi-

cally via the Internet **110** such as through an email. As noted previously, when such a (notification) email is sent, the email may include an on-demand URL link and/or an actual PNG image attachment. Emails can be sent under different scenarios (e.g., the dashboard generator **106** can be configured to send such an email when KPI values change state, on a periodic/scheduled basis, or when an interactive viewer annotates data on a dashboard). If the dashboard generator **106** is configured to send emails periodically, and dashboard image data **130'** is included with the email as an attachment, then the sequence of emails serves as a history of dashboard images **130**.

As a further convenience, the dashboard URL query parameters can effectively be saved by the dashboard generator **106** into its internal database or by the browser on the remote computing device(s) **104A**, **104B**, **104C** in the form of a “bookmark”. The saved bookmark may have its own identifier (GUID) which allows end-users/remote viewers to recall the bookmark (and view the corresponding dashboard image **130**) simply by referencing its identifier. In this case, there is no need to supply the full set of URL query parameters because they are recalled automatically from the database.

An example of a shorter and simpler URL for viewing a dashboard image with the timestamp option enabled might look as follows: “http://dashsvr/ShowDashboardImage.aspx?BookmarkId=8f1e2234-1522-4366-bbf5-53fcc16b987f&isTimeStampShown=1”.

It will be understood that while the term databases are illustrated and used in the present disclosure, any suitable method of persistent storage (e.g., a fixed format file system) may be used in the role of the illustrated databases. It will also be understood by a person skilled in the art that data and/or databases illustrated and/or described separately herein can be stored together as separate files or data elements within the same or multiple databases both locally and/or remotely.

It will also be understood that other system arrangements and configurations may be possible. It will be understood by persons skilled in the art that variations are possible in variant implementations and embodiments. Such variations include, but are not limited to, variations in the connectivity amongst described components, the sequence of execution by described components and the organization of described components.

The steps of a method in accordance with any of the embodiments described herein may be provided as executable software instructions stored on computer-readable media, which may include transmission-type media. Such steps may not be required to be performed in any particular order, whether or not such steps are described in claims or otherwise in numbered or lettered paragraphs.

The invention has been described with regard to a number of embodiments. However, it will be understood by persons skilled in the art that other variants and modifications may be made without departing from the scope of the invention as defined in the claims appended hereto.

The invention claimed is:

1. A method for generating a static image of an interactive dashboard for viewing on a remote computing device, the method comprising:

receiving a dashboard request, the dashboard request comprising data identifying the interactive dashboard and data specifying a state for one or more dashboard filters to be applied to the interactive dashboard;

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in response to receiving the dashboard request:  
 transmitting, to an image generator, a dashboard image request corresponding to the dashboard request, the image generator comprising an image generation service and an instance of an image generation client application; and  
 receiving, from the instance of the image generation client application, at least one query parameter corresponding to the dashboard image request;  
 in response to receiving the at least one query parameter:  
 deriving one or more key performance indicator values from business data stored in a business database; and  
 transmitting the one or more key performance indicator values to the instance of the image generation client application, the instance of the image generation client application rendering the interactive dashboard and generating an image data file comprising a static image of the rendered interactive dashboard in response to receipt of the one or more key performance indicator value;  
 receiving, from the instance of the image generation client application, the image data file comprising the static image of the interactive dashboard; and  
 transmitting the image data file to the remote computing device.

2. The method of claim 1, wherein the image data file is transmitted to the remote computing device via an email message.

3. The method of claim 2, wherein the image data file is transmitted to the remote computing device in response to a determination that one of the one or more key performance indicator values has changed state.

4. The method of claim 2, wherein the image data file is transmitted to the remote computing device in response to a determination that data corresponding to one of the one or more key performance indicator values has been annotated.

5. The method of claim 2, wherein the image data file is transmitted to the remote computing device on a periodic basis.

6. The method of claim 1, wherein the static image comprises an embedded timestamp.

7. The method of claim 1, wherein the data identifying the interactive dashboard comprises a globally unique identifier associated with the interactive dashboard.

8. The method of claim 1, wherein the dashboard request comprises a uniform resource locator (URL).

9. The method of claim 1, wherein the dashboard request is received from the remote computing device.

10. The method of claim 1, wherein the dashboard request is received at a first server computer, and the image generator is located at a second server computer.

11. A first computing device comprising a processor and a memory, the processor configured to execute instructions of one or more application modules, the execution of the one or more application modules causing the processor to:  
 receive a dashboard request, the dashboard request comprising data identifying an interactive dashboard and data specifying a state for one or more dashboard filters to be applied to the interactive dashboard;

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in response to receiving the dashboard request:  
 transmit, to an image generator, a dashboard image request corresponding to the dashboard request, the image generator comprising an image generation service and an instance of an image generation client application;  
 receive, from the instance of the image generation client application, at least one query parameter corresponding to the dashboard image request;  
 in response to receiving the at least one query parameter:  
 derive one or more key performance indicator values from business data stored in a business database; and  
 transmit the one or more key performance indicator values to the instance of the image generation client application, the instance of the image generation client application rendering the interactive dashboard and generating an image data file comprising a static image of the rendered interactive dashboard in response to receipt of the one or more key performance indicator values;  
 receive, from the instance of the image generation client application, the image data file comprising the static image of the interactive dashboard; and  
 transmit the image data file to a first remote computing device.

12. The first computing device of claim 11, wherein the image data file is transmitted to the remote computing device via an email message.

13. The first computing device of claim 12, wherein the execution of the one or more application modules further causes the processor to transmit the image data file to the first remote computing device in response to a determination that one of the one or more key performance indicator values has changed state.

14. The first computing device of claim 12, wherein the execution of the one or more application modules further causes the processor to transmit the image data file to the first remote computing device in response to a determination that data corresponding to one of the one or more key performance indicator values has been annotated.

15. The first computing device of claim 12, wherein the execution of the one or more application modules further causes the processor to transmit the image data file to the first remote computing device on a periodic basis.

16. The first computing device of claim 11, wherein the static image comprises an embedded timestamp.

17. The first computing device of claim 11, wherein the data identifying the interactive dashboard comprises a globally unique identifier associated with the interactive dashboard.

18. The first computing device of claim 11, wherein the dashboard request comprises a uniform resource locator (URL).

19. The first computing device of claim 11, wherein the dashboard request is received from a second remote computing device.

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